Claims

1.(amended)   An   optical   Fourier   transform   device
comprising:

5   a parabolic optical pulse generator to generate a control
optical pulse of a shape expressed by a quadratic function or a
parabola;

        a coupler to couple a signal optical pulse with the control
optical pulse;

10   an optical Kerr medium to linearly chirp the signal optical
pulse over an entire pulse or a wide time range by cross phase
modulation between the signal optical pulse and the control optical
pulse; and

        a dispersive medium having a group-velocity dispersion,

15   wherein

        the launched signal optical pulse and the control optical
pulse are coupled by the coupler and are introduced into the optical
Kerr medium, the launched signal optical pulse is linearly chirped
at a chirp rate K by the optical Kerr medium by the cross phase

20 modulation between the signal optical pulse and the control optical
pulse, the signal optical pulse emitted from the optical Kerr medium
is made to pass through the dispersive medium whose dispersion
amount D is D=1/K, to convert a temporal waveform of the launched
signal optical pulse into a shape of a frequency spectrum thereof.

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        2.   The optical Fourier transform device according to claim
1, wherein

        the signal optical pulse having passed through the dispersive
medium and the control optical pulse are again coupled and are

30 introduced into the optical Kerr medium, the signal optical pulse
having passed through the dispersive medium is again linearly
chirped by the optical Kerr medium by the cross phase modulation

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between the signal optical pulse and the control optical pulse, to convert the temporal waveform of the launched signal optical pulse into the shape of the frequency spectrum thereof, and the shape of the frequency spectrum of the launched signal optical pulse into the temporal waveform thereof.

3. The optical Fourier transform device according to claim 1 or 2, wherein

the signal optical pulse is made to pass through the optical Kerr medium twice so that chirp is completely compensated, and a transform-limited waveform without chirp is obtained at output.

4. The optical Fourier transform device according to claim 2, further comprising:

an optical filter that separates the signal optical pulse having passed through the optical Kerr medium from the control optical pulse and introduces the separated signal optical pulse into the dispersive medium; and

a coupler that again couples the signal optical pulse having passed through the dispersive medium and the separated control optical pulse and introduces them into the optical Kerr medium.

5.(amended)   An   optical   Fourier   transform   device comprising:

a parabolic optical pulse generator to generate a control optical pulse of a shape expressed by a quadratic function or a parabola;

a coupler to couple a signal optical pulse with the control optical pulse;

an optical Kerr medium to linearly chirp the signal optical pulse over an entire pulse or a wide time range by cross phase modulation between the signal optical pulse and the control optical

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pulse; and

a dispersive medium having a group-velocity dispersion, wherein

the parabolic optical pulse generator comprises:

5   a optical pulse transmitter to generate a optical pulse; and

a dispersion-decreasing fiber in which an absolute value of a normal dispersion is decreased in a longitudinal direction,

10   the launched signal optical pulse is made to passes through the dispersive medium, the signal optical pulse emitted from the dispersive medium and the control optical pulse are coupled by the coupler and are introduced into the optical Kerr medium, the signal optical pulse emitted from the dispersive medium is linearly

15   chirped by the optical Kerr medium by the cross phase modulation between the signal optical pulse and the control optical pulse, to convert a shape of a frequency spectrum of the launched signal optical pulse into a temporal waveform.

20   6.   The optical Fourier transform device according to claim 5, wherein

the signal optical pulse linearly chirped by the optical Kerr medium is again made to pass through the dispersive medium, to convert the temporal waveform of the launched signal optical pulse

25   into the shape of the frequency spectrum thereof, and the shape of the frequency spectrum of the launched signal optical pulse into the temporal waveform thereof.

7.   The optical Fourier transform device according to claim

30   5 or 6, wherein

the signal optical pulse is made to pass through the dispersive medium twice so that chirp is completely compensated,

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and a transform-limited waveform without chirp is obtained at output.

8.(amended)   The optical Fourier transform device according to claim 1, wherein

a chirp rate K of a frequency chirp applied to the signal optical pulse by the cross phase modulation between the signal optical pulse and the control optical pulse by the optical Kerr medium and a dispersion amount D of the dispersive medium satisfy a relation of D = 1/K, and the chirp rate K can be adjusted by one of or plurality of a peak power of the control optical pulse, a length of the optical Kerr medium, and a nonlinear refractive index of the optical Kerr medium.

9.(amended)   The optical Fourier transform device according to claim 1, wherein the parabolic optical pulse generator comprises:

an optical pulse transmitter to generate an optical pulse; and

an optical fiber amplifier which has a normal dispersion and through which the optical pulse from the optical pulse transmitter is transmitted.

10.(amended)   An optical Fourier transform device comprising:

a parabolic optical pulse generator to generate a control optical pulse of a shape expressed by a quadratic function or a parabola;

a coupler to couple a signal optical pulse with the control optical pulse;

an optical Kerr medium to linearly chirp the signal optical pulse over an entire pulse or a wide time range by cross phase

modulation between the signal optical pulse and the control optical pulse; and

a dispersive medium having a group-velocity dispersion, wherein

5   the parabolic optical pulse generator comprises:

a optical pulse transmitter to generate a optical pulse; and

a dispersion-decreasing fiber in which an absolute value of a normal dispersion is decreased in a longitudinal

10   direction,

the launched signal optical pulse and the control optical pulse are coupled by the coupler and are introduced into the optical Kerr medium, the launched signal optical pulse is linearly chirped by the optical Kerr medium by the cross phase modulation between

15   the signal optical pulse and the control optical pulse, the signal optical pulse emitted from the optical Kerr medium is made to pass through the dispersive medium, to convert a temporal waveform of the launched signal optical pulse into a shape of a frequency spectrum thereof.

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11. The optical Fourier transform device according to claim 10, wherein

the dispersion-decreasing fiber includes fibers in which a change in a dispersion value is discretely approximated in each

25   section by cascading plural kinds of optical fibers in which a dispersion value is continuously changed, or a dispersion value is constant or is linearly changed in a longitudinal direction, or one fiber in which a dispersion value is continuously changed, and the change in the dispersion value is expressed by a following

30   expression or is approximated by the following expression

$D(z) = D_0/(1 + D_0\Gamma z)$

(where $D(z)$: a function to express the change in the dispersion

value, z: a coordinate of the fiber in the longitudinal direction, D_0: a function value at an incident end (z = 0), and Γ: a rate of decrease of magnitude of the normal dispersion).

5   12.(amended)   The optical Fourier transform device according to claim 1, wherein the parabolic optical pulse generator comprises:

an optical pulse transmitter to generate an optical pulse;

an optical filter whose amplitude transmission
10   characteristic is expressed by a quadratic function or a parabola, and which changes a frequency spectrum of the optical pulse from the optical pulse transmitter into a quadratic function type or a parabola; and

an optical Fourier transform circuit to convert a temporal
15   waveform of the optical pulse into a shape of a frequency spectrum waveform of the optical pulse having passed through the optical filter.

13.(amended)   The optical Fourier transform device
20   according to claim 1, wherein

in order to efficiently generate the high-speed cross phase modulation between the control light and the signal light, a low dispersion optical Kerr medium having a small dispersion value is used as the optical Kerr medium, or a wavelength of the signal light
25   and/or the control light is set so that wavelengths of the signal light and the control light become wavelengths symmetrical to each other with respect to a zero-dispersion wavelength of the optical Kerr medium.

30   14.(amended)   The optical Fourier transform device according to claim 1, further comprising:

a clock extraction circuit to extract a clock signal based

on the signal optical pulse, and

an optical delay element to give an optical delay to the control optical pulse,

wherein the parabolic optical pulse generator generates the
5   control optical pulse in accordance with the clock signal from the clock extraction circuit, and/or the optical delay element gives the optical delay to the control optical pulse so that timing is matched with the signal optical pulse.

10   15.(amended)   An optical Fourier transform method wherein an launched signal optical pulse and a control optical pulse of a shape expressed by a quadratic function or a parabola are coupled and are introduced into an optical Kerr medium, the launched signal optical pulse is linearly chirped at a chirp rate K over
15   an entire pulse or a wide time range by the optical Kerr medium by the cross phase modulation between the signal optical pulse and the control optical pulse, the signal optical pulse emitted from the optical Kerr medium is made to pass through the dispersive medium having a group-velocity dispersion whose dispersion amount D is
20   D=1/K, to convert a temporal waveform of the launched signal optical pulse into a shape of a frequency spectrum thereof.

16.   The optical Fourier transform method according to claim 15, wherein
25   the signal optical pulse having passed through the dispersive medium and the control optical pulse are again coupled and are introduced into the optical Kerr medium, the signal optical pulse having passed through the dispersive medium is again linearly chirped by the optical Kerr medium by the cross phase modulation
30   between the signal optical pulse and the control optical pulse, to convert the temporal waveform of the launched signal optical pulse into the shape of the frequency spectrum thereof, and the

shape of the frequency spectrum of the launched signal optical pulse
into the temporal waveform thereof.

17.(canceled)

18.(canceled)